Cluster Establishment in Vehicular Networks Connectivity Enhancement

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Overview

I. Introduction

II. Methodologies

III. Tools and Implementation

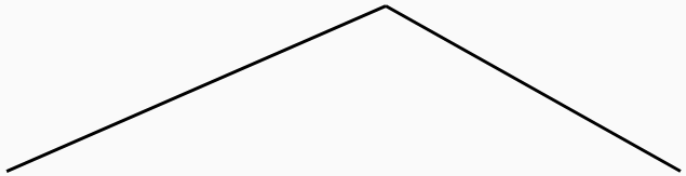
IV. Results

V. Conclusion and Future Works

I. Introduction

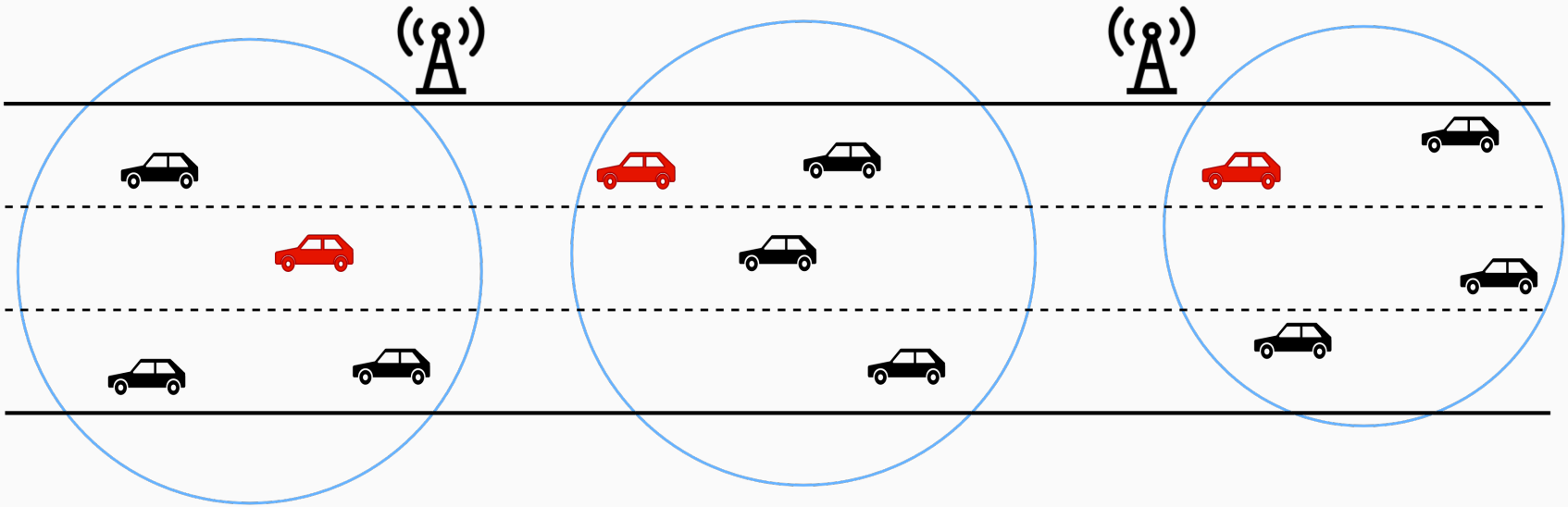
Vehicular Ad-hoc Networks (VANETs)

the special type of Mobile Ad-hoc Networks that aims at providing communication among vehicles on roads.



Safety Application	Non-safety Application
- accidents	- entertainment
- road hazard	- traffic congestion
- emergency	- parking

2 - Connectivity Problem & Solution



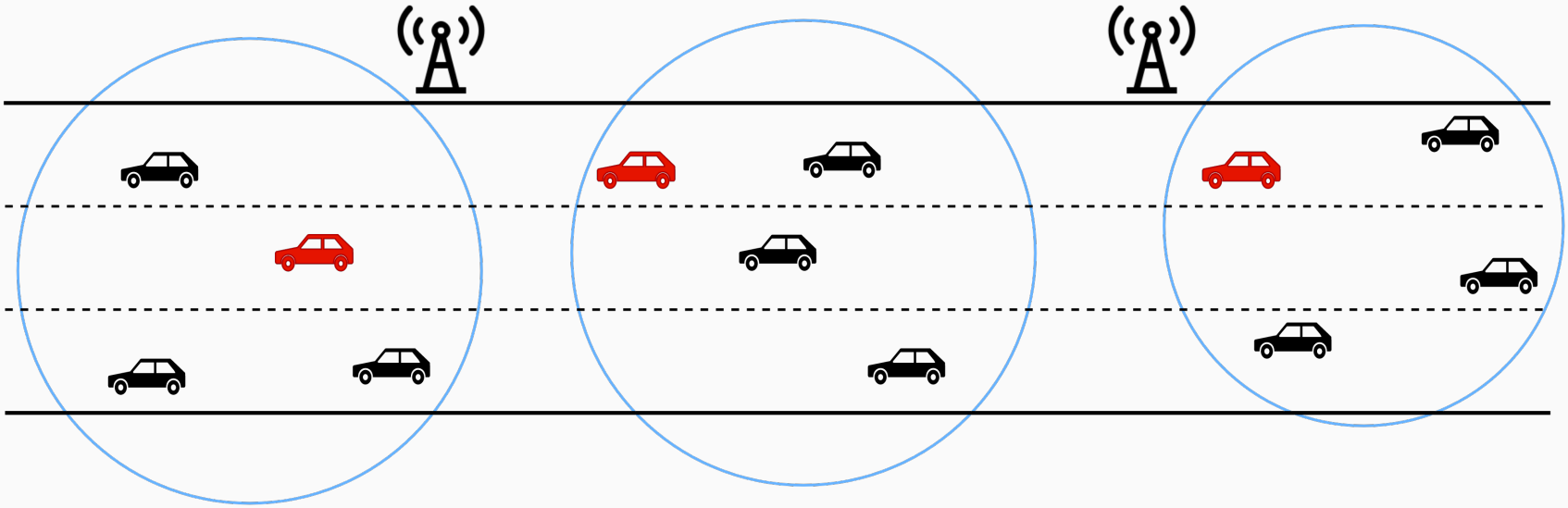
- Problems: Communication overhead/failures
- Solution: **Cluster Establishment**

3 - Objectives

- Constructing the protocol in each **process**.
- Implementing the protocol on **NS-3** simulator.
- Running the simulation and analysing the **results**.

II. Methodologies

1 - Protocol Description



Construct:

- NodeState
- Time Cycle
- Algorithms

2 - Protocol Description

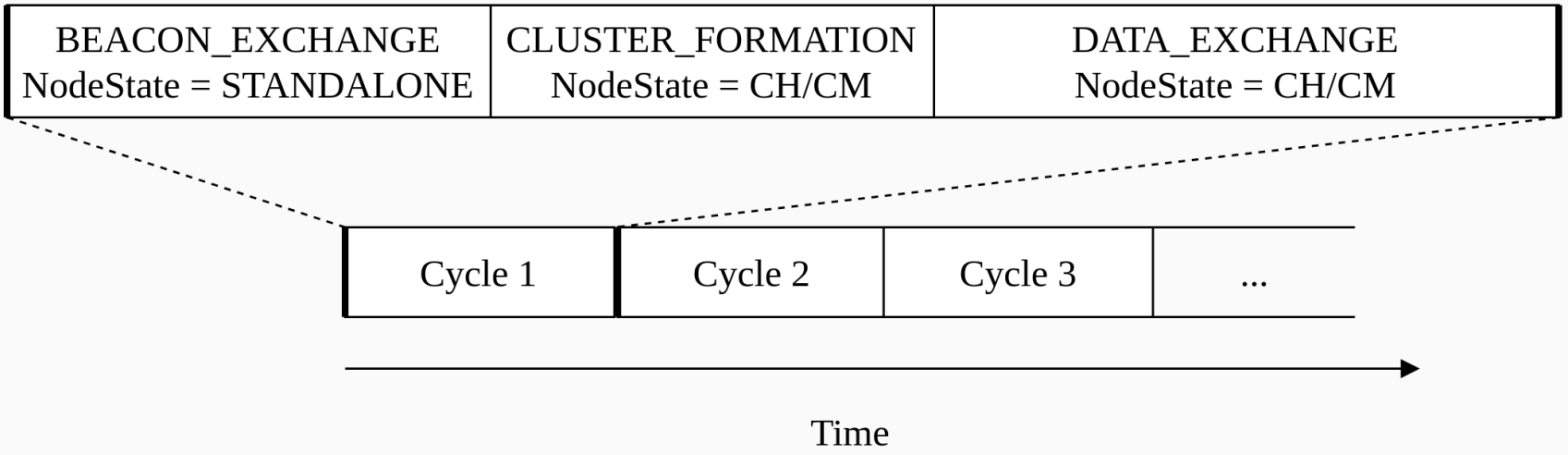


Figure 1: Processes in a Time Cycle

3 - BEACON_EXCHANGE Process

Nodes:

- broadcast **beacon messages**
- update their table of stable neighbors
- keep track with the closest RSU

4 - CLUSTER_FORMATION Process

Node:

- waits to become a CH
- joins other cluster if it receives FormClusterMessage
- otherwise, declares itself as CH.

5 - DATA_EXCHANGE Process

- Intra-cluster communication
  - Direct transmission
  - Indirect transmission
- Inter-cluster communication
  - CH roles: forward packet to nearest RSU
  - RSU roles: forward packet to the destination cluster
  - Core network

III. Tools and Implementations

1 - NS-3 Network Simulator

__NS-3__ simulator is a discrete-event network simulator targeted primarily for research and educational use.‘

- Simulates the real world network on computer
- C++, Python
- Maintains an implementation for WAVE

2 - Implementation

- **Applications**: for vehicles and for RSUs
- **Headers**: for different packet types

2 - Implementation

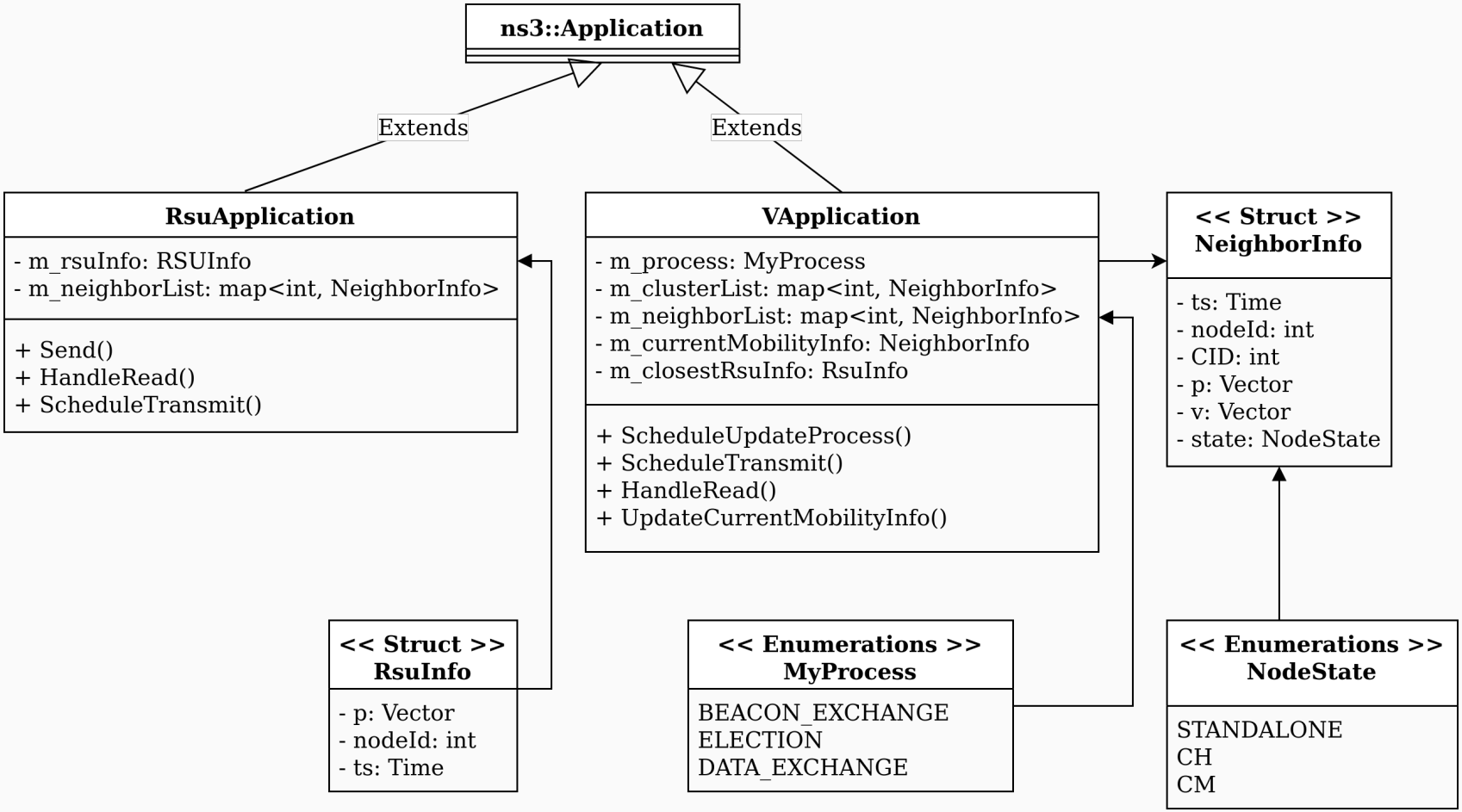


Figure 2: Class designs for VApplication and RsuApplication

2 - Implementation

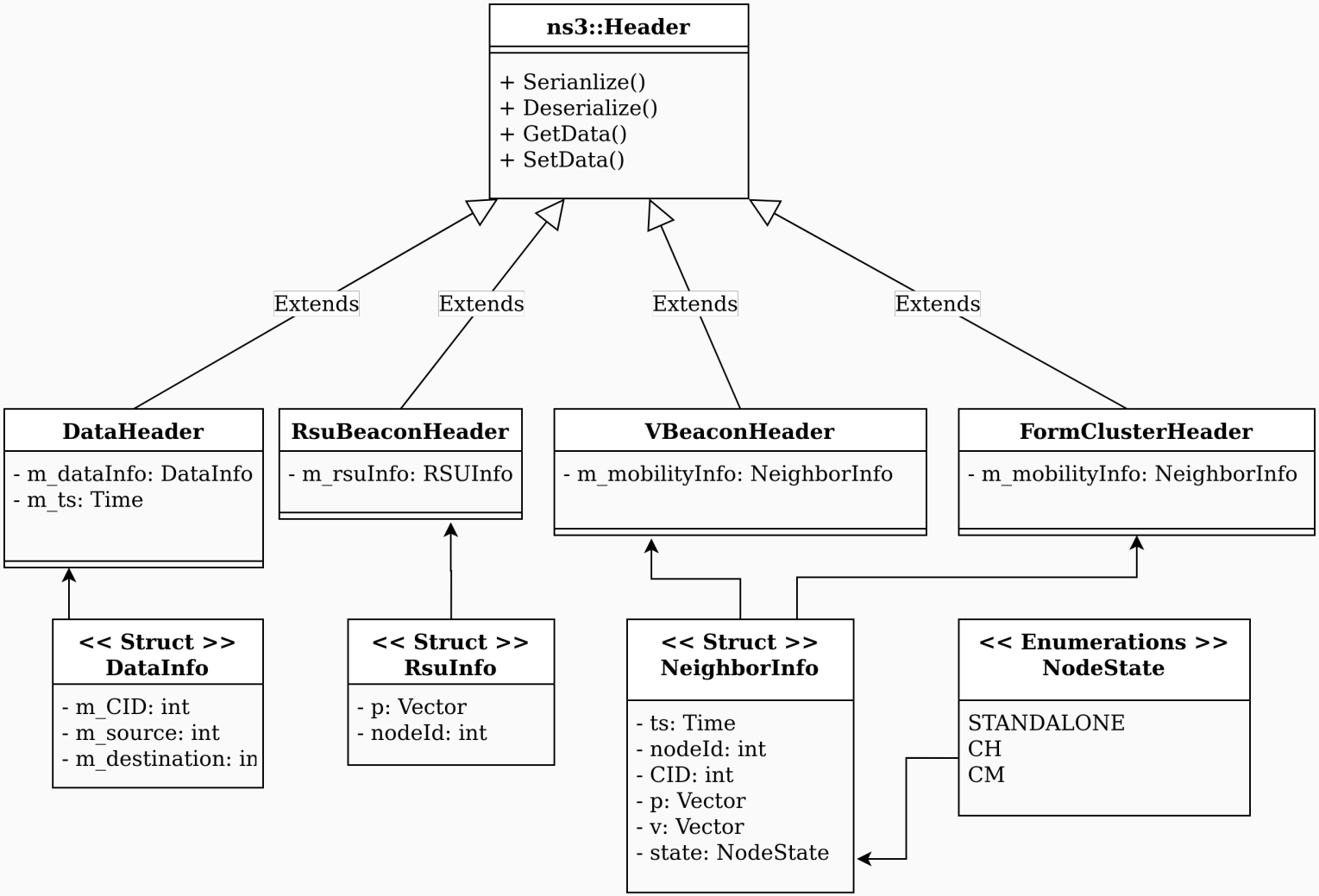


Figure 3: Designs for headers

IV. Results

1 - Scenarios Descriptions

- Scenarios:
  - Stable
  - Non-stable
- Metrics:
  - PDR: Packet Delivery Ratio

1 - Scenarios Descriptions

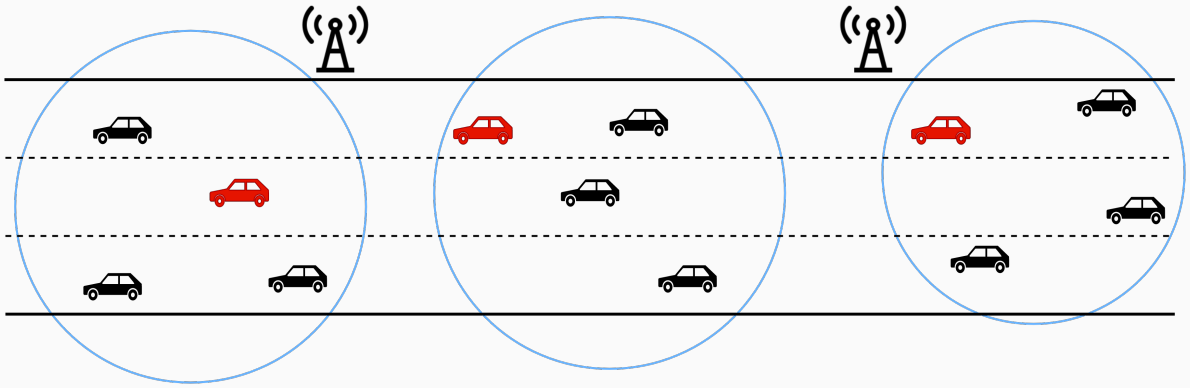


Table 1: Common configuration parameters of the clustering scenarios

Parameter	Value
Position range	[0m, 100m]
Mobility Model	Constant Velocity
Simulation Time	33s
Number of Vehicles	5/10/15/20/25/30/35/40/45
Distance between two adjacent RSUs	100m

2 - Stable Scenario

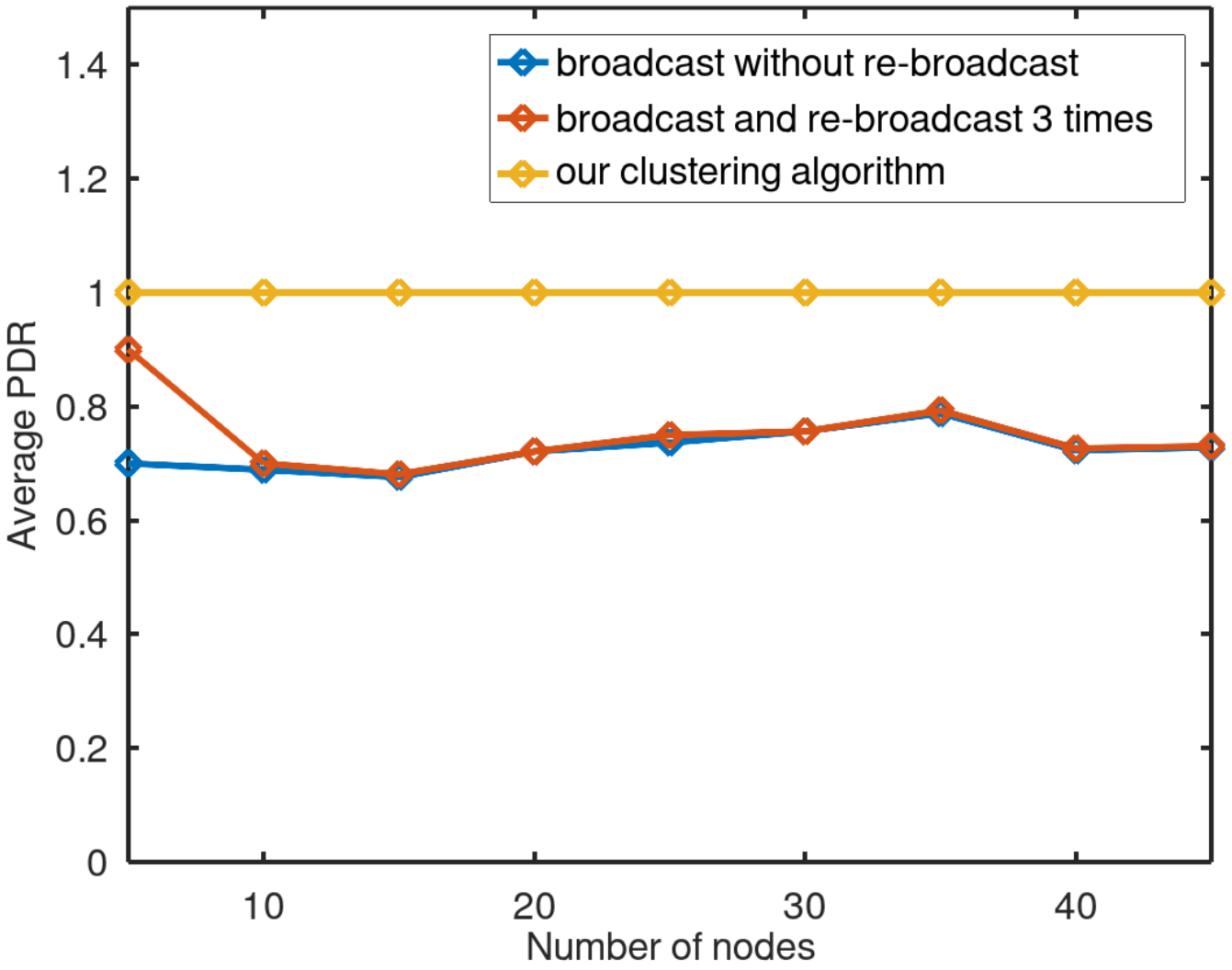


Figure 4: Stable Scenario

3 - Non-stable Scenario

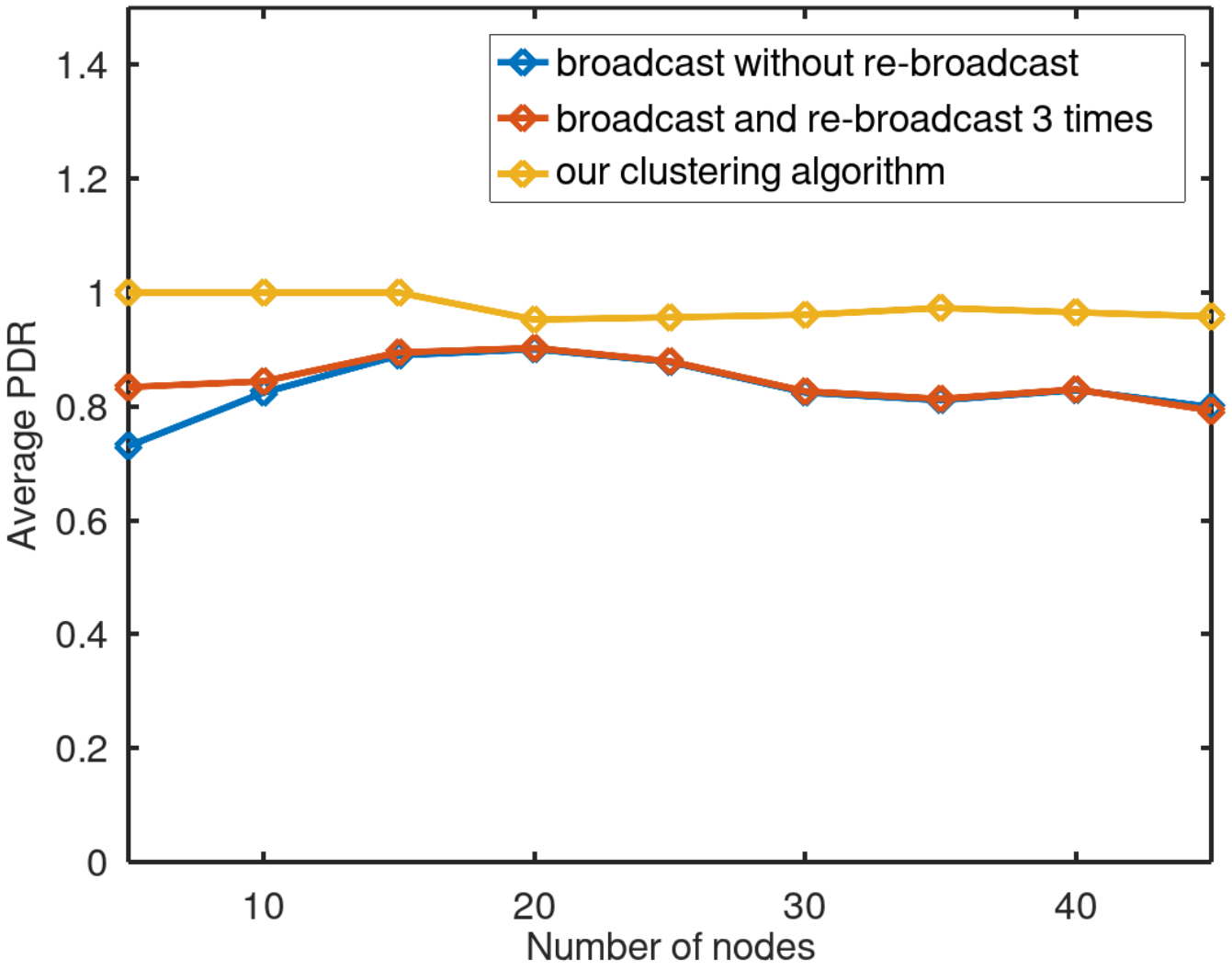


Figure 5: Non-stable Scenario

4 - Analysis on Cycle Time Value

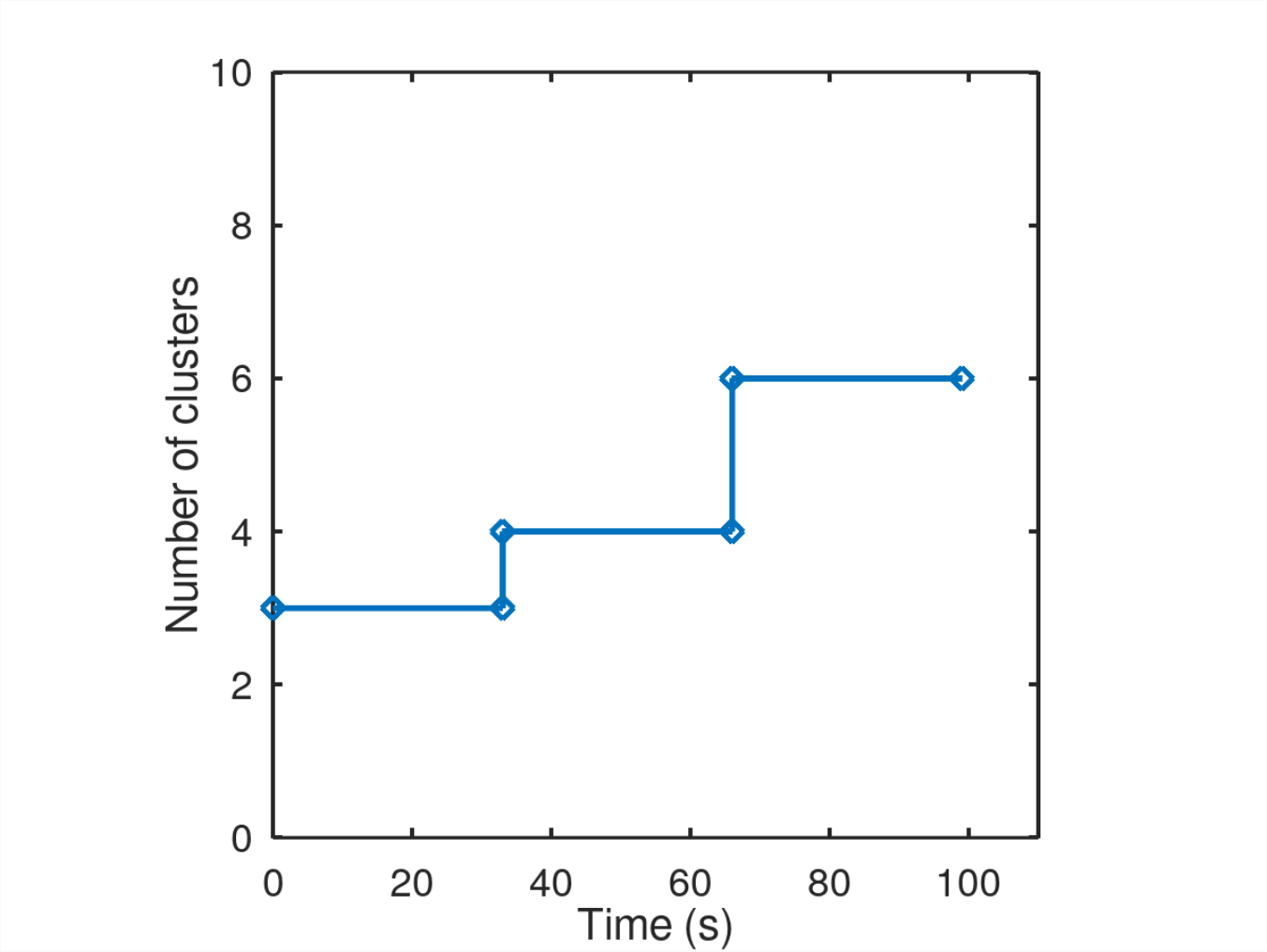


Figure 6: Number of clusters created in the first 100 seconds with cycle time equals 33 seconds

4 - Analysis on Cycle Time Value

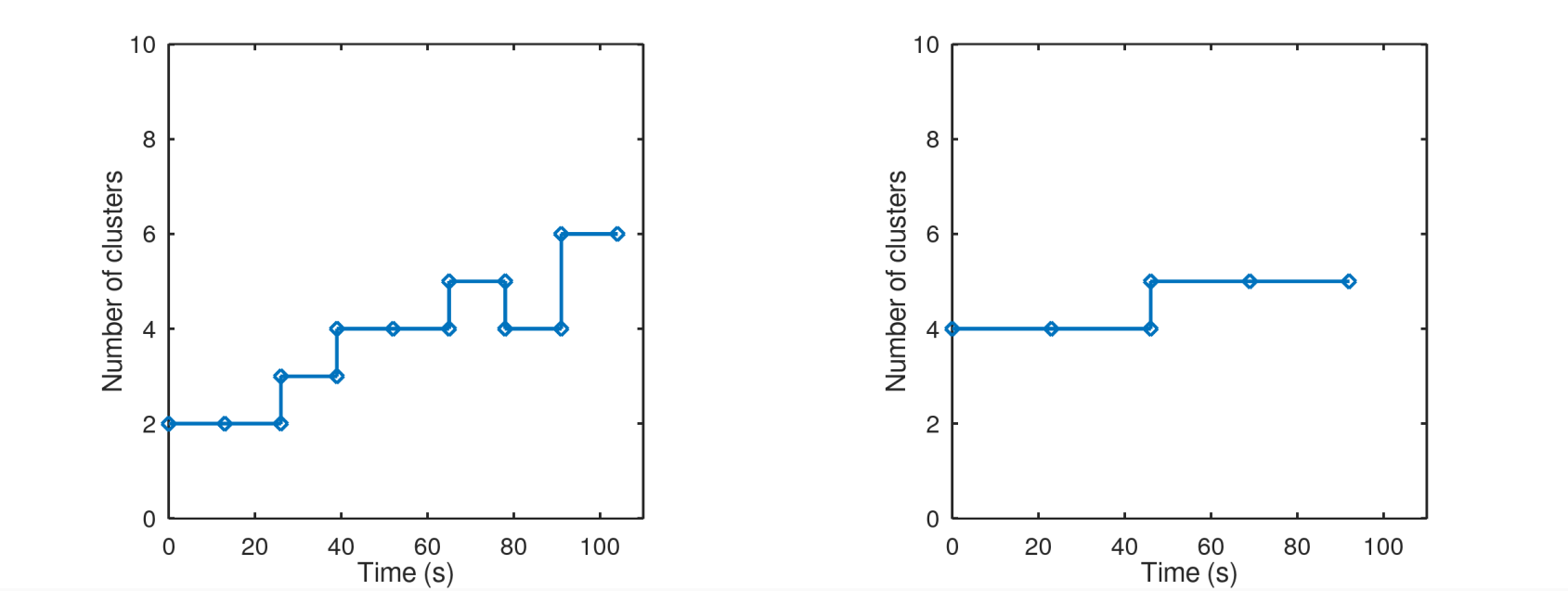


Figure 7: Number of clusters created in the first 100 seconds of simulation with cycle time is (a) 13 seconds and (b) 23 seconds

V. Conclusion and Future Work

- **Inter-cluster** communication implementations
- More practical **scenarios**
- Proper values for algorithm specific **parameters**

Thank you for listening!